

### REMARKS

The application has been thoroughly reviewed in light of the Office Action dated March 4, 2004. Claims 1-3, 25, 43, 119, 124, 129, 131-134, and 136-139 have been amended. Claim 66 has been canceled. No new matter has been added. Therefore, claims 1-4, 7-15, 18-23, 25-29, 31-39, 41-63, 65, and 115-144 are currently pending. Reconsideration and withdrawal of all outstanding rejections are respectfully requested in light of the foregoing amendments and the following remarks.

Claims 1-4, 7-13, and 120 stand rejected under 35 U.S.C. § 102 as allegedly being anticipated by U.S. Patent No. 5,804,845 to Anagnostopoulos et al (hereinafter "Anagnostopoulos").

The Office Action asserts that "[t]he 'nitrogen containing second insulating' layer reads on an ONO layer or NO layer as in Anagnostopoulos et al." Further, the Office Action asserts that "[t]he 'first' and 'second' gate stacks read on electrodes 32 with 'photogate' 30;" that "[f]or claim 2, as an alternative, in Figures 3B, 3C, the 'first' & 'second' gate stacks read on electrodes 30 with 'photogate' 32;" and that "[t]he 'first' insulating layer reads on silicon dioxide layer 36 (figure 3A), on ONO layer or layer 43 (Figure 3B), and on NO layer or layer 52 (Figure 3C). Office Action, at 3.

Applicant respectfully disagrees. None of the embodiments of Anagnostopoulos relied upon in the Office Action (Figs. 3A, 3B, and 3C) anticipates Applicant's claimed invention, which includes both a first insulating layer disposed beneath each of the first and second gate stacks, and "a nitrogen containing second insulating layer *distinct from said first insulating layer*, said second insulating layer being in contact with the substrate and being located beneath said photogate" as recited by independent claim 1. Moreover, claims 2-4, 7-13, and 120 each depend, either directly

or indirectly from claim 1; therefore, Applicant respectfully submits that Anagnostopoulos does not anticipate these claims.

The assertions made in the Office Action argue that layer 36 anticipates both the first and second insulating layer elements, as recited in Applicant's claim 1. Applicant respectfully submits that layer 36 cannot be *both* a first layer, *and* part of a second *distinct* insulating layer. Additionally, claims 9 and 13, which recite that ONO is the "nitrogen containing *second* insulating layer," each depend from claim 1, either directly or indirectly; therefore, they also contain a distinct "first insulating layer in contact with said substrate."

This discrepancy between the claimed invention and that disclosed by Anagnostopoulos can be seen in the Figures accompanying each invention. Applicant's Fig. 10 depicts two distinct insulating layers, the first layer 315 beneath two gate stacks 320, 325 and the second layer containing nitrogen (315 and 330, respectively) each in contact with the substrate 310. In each of Anagnostopoulos' Figs. 3A-3C, however, only one layer is contiguous with the substrate. For example, in Fig. 3A, only layer 36 is in contact with the substrate. Even if layer 36 is part of an ONO layer, as noted by the examiner, Anagnostopoulos' invention does not have two distinct layers in contact with the substrate.

Similarly, in the structure depicted in Anagnostopoulos' Fig. 3B, the entire ONO stack lies beneath both electrodes. In fact, Anagnostopoulos even explicitly states as much, to wit: "Here, ITO electrodes 30 and polysilicon electrodes 32 are formed upon an ONO stack comprising three layers that completely run beneath the electrodes." Col. 5, lines 15-17. But, Anagnostopoulos' Fig. 3B embodiment does not have both "a *first* insulating layer in contact with said substrate and beneath each of said first and second gate stacks" and "a nitrogen containing *second* insulating layer

distinct from said first insulating layer, said second insulating layer being in contact with said substrate and being located beneath said photogate," as claimed. (See Applicant's Fig. 10).

Finally, the prior art disclosed in Anagnostopoulos' Fig. 3C discloses that SiO<sub>2</sub> layer 52 is located between the substrate and the nitride layer 51. There is no teaching of both "a first insulating layer in contact with said substrate and beneath each of said first and second gate stacks" and "a nitrogen containing *second* insulating layer *distinct from said first insulating layer, said second insulating layer being in contact with said substrate,*" as claimed.

MPEP 2131 states that in order for a reference to anticipate the claimed invention "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim," and "[t]he elements must be arranged as required by the claim. . . ." Because Anagnostopoulos does not teach each of the elements, namely two distinct insulating layers, or the contiguous arrangement of such elements with the substrate as required in claims 1-4, 7-13, and 120, Anagnostopoulos does not anticipate the claimed invention.

For at least the above reasons, reconsideration and withdrawal of the rejections of claims 1-4, 7-13, and 120 under § 102 are respectfully requested.

Claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41-44, 46, 51, 53-55, 57-59, 115-125, and 135-139 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over "the acknowledged prior art in this application (Figures 1, 2, pages 1-12) and U.S. Patent No. 5,307,169 to Nagasaki et al. ("Nagasaki"), considered together."

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

The claimed invention would not have been obvious because the combination fails to “teach or suggest all the claim limitations” recited in Applicant’s claims. Moreover, there is no “suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine [the] reference teachings” to attain the claimed invention. MPEP § 2143.

The asserted combination fails to teach or suggest Applicant’s claimed imaging device comprising a “nitrogen containing second insulating layer distinct from said first insulating layer, said second insulating layer being in contact with said substrate and being located beneath said photogate” as recited in Applicant’s claim 1.

It is respectfully submitted that the disclosure of Nagasaki cannot compensate for the deficiency of “the acknowledged prior art.” Nagasaki discloses a solid-state imaging device containing an insulating film made of “a high dielectric material having a *high* relative dielectric constant” (column 11, lines 20-22) (emphasis added). The Office Action suggests “it would have been obvious to use a photogate insulator with higher dielectric constant, as suggested by Nagasaki et al. in order to increase the capacity of the photogate.” Office Action, at 3-4.

The Applicant respectfully disagrees. While Nagasaki teaches the use of a high dielectric material as an insulating film, it also specifically teaches that silicon oxide and silicone nitride are *low* dielectric constant materials, while antiferroelectrics and ferroelectrics are high dielectric materials (column 3, lines 20-28). Nagasaki then

proceeds to unequivocally and repeatedly exclude the use of low dielectric materials, including silicone oxide and silicone nitride, in its invention (column 4, line 57; column 5, line 42; column 6, line 33; column 6, lines 57-59; etc.).

Nagasaki *teaches* the use of “a high dielectric material having a *high* relative dielectric constant” (column 1, lines 65-66). In Table 1 (column 3), Nagasaki discloses that “SiO<sub>2</sub>” is a “low dielectric material” with a relative dielectric constant of 4.5, and that “Si<sub>3</sub>N<sub>4</sub>” is a “low dielectric material” with a relative dielectric constant of 10. Every other entry in Table 1, none of which includes nitrogen, is described as a “high dielectric material.”

Therefore, simply because Si<sub>3</sub>N<sub>4</sub> has a higher relative dielectric constant than SiO<sub>2</sub> does not mean that the nitrogen containing Si<sub>3</sub>N<sub>4</sub> would be acceptable to Nagasaki. Nagasaki teaches the use of “a high dielectric material having a *high* relative dielectric constant,” and the only nitrogen containing material discussed in the reference, Si<sub>3</sub>N<sub>4</sub>, is described by Nagasaki as being “a *low* dielectric material.”

Thus, there is no objective motivation or suggestion to combine the cited references to achieve the subject matter of the current claims, absent application of impermissible hindsight using the application as a roadmap. The Applicant points to MPEP § 2145 X (D)(2), which states that “[i]t is improper to combine references where the references teach away from their combination.” (citing *In Re Grasselli*, 713 F.2d 731 (Fed. Cir. 1983)). The Court of Appeals for the Federal Circuit held in *In re Grasselli* that it was inappropriate for an examiner to combine references for a § 103 rejection where one of the references expressly excludes the use of a compound for a desired result where that compound is part of the claimed combination.

As established above, by teaching the use of a material having a *high* relative dielectric constant, and by defining  $\text{Si}_3\text{N}_4$  as a low dielectric constant material, Nagasaki clearly teaches away from using nitrogen containing insulating materials. Nagasaki thus teaches away from Applicant's claimed invention. Furthermore, Nagasaki does not teach a "first insulating layer in contact with said substrate and beneath each of said first and second gate stacks" and a "nitrogen containing second insulating layer distinct from said first insulating layer," as recited by claim 1. In fact, as shown in Fig. 3, Nagasaki does not disclose or even suggest a second insulating layer. From the teaching of Nagasaki, therefore, it is not plausible to suggest that one of ordinary skill in the art would have used Applicant's claimed nitrogen containing material in place of a silicon oxide as a second insulating layer.

The Office Action asserts that it would have been obvious to use an insulator with a higher dielectric constant to increase the capacity of the photogate. No reference is cited, however, which suggests the use of a nitrogen containing insulating layer in the location claimed. Nagasaki does not teach or suggest that a nitrogen containing insulating layer would be useful for any purpose in the location claimed, much less to achieve the improved signal acquisition, wider dynamic range, and improved signal to noise ratio discussed, for example, at page 13, lines 10-20, and page 18, lines 20-24, of the specification.

Thus, the asserted combination would not have rendered obvious the various embodiments of the invention defined by rejected independent claim 1. The rejected dependent claims 2-3, 7, 12, 115, 120, and 135 are allowable along with the aforementioned independent claim and on their own merits.

Independent claim 14 recites an "imaging device including a semiconductor integrated circuit substrate . . . comprising . . . a nitrogen containing insulating material

in contact with said substrate and beneath said photogate.” Applicant submits that claim 14 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 15, 18, 19, 25, 26, 116, 121, and 136 depend from claim 14, and contain all the limitations of claim 14. Claims 15, 18, 19, 25, 26, 116, 121, and 136 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 14, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Independent claim 28 recites “an imaging system . . . wherein a nitrogen containing insulating layer is in contact with said substrate and beneath said photogate.” Applicant submits that claim 28 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 29, 31-33, 38, 117, 122, and 137 depend from claim 28, and contain all the limitations of claim 28. Claims 29, 31-33, 38, 117, 122, and 137 are believed to be in immediate condition for allowance at least for those reasons outlined above for the allowance of claim 28, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Independent claim 39 recites “an imaging system . . . wherein a nitrogen containing insulating layer is in contact with said substrate and beneath said photogate.” Applicant submits that claim 39 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 41-44, 46, 51, 118, 123, and 138 depend from claim 39, and contain all the limitations of claim 39. Claims 41-44, 46, 51, 118, 123, and 138 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 39, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Independent claim 53 recites a “system comprising . . . a CMOS imaging device . . . including . . . a nitrogen containing insulating layer in contact with said substrate and beneath said photogate.” Applicant submits that claim 53 is allowable for the same reasons as outlined above for allowance of claim 1 under § 103.

Claims 54-55, 57-59, 119, 124, and 139 depend from claim 53, and contain all the limitations of claim 53. Claims 54-55, 57-59, 119, 124, and 139 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 53, and also because the unique combinations of elements recited in these dependent claims are neither taught nor suggested by the cited combination of references.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41, 44, 46, 51, 53-55, 57-59, 115-124, and 135-139 under § 103 are respectfully requested.

Claims 2, 4, 25, 27, 43, 45, 54, 56, 126-134 and 140-144 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the “acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki et al., further considered together with [U.S. Patent No. 4,143,389 to] Koike et al,” (“Koike”). Office Action, at 4.



The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Furthermore, it is respectfully submitted that the disclosure of Koike cannot compensate for the above-described deficiency of Nagasaki. The independent claims from which claims 2, 4, 25, 27, 43, 45, 54, 56, 126-134 and 140-144 depend recite a nitrogen containing insulating layer in contact with the substrate and beneath the photogate. Koike does not suggest a nitrogen containing insulating layer. For this reason alone, claims 2, 4, 25, 27, 43, 45, 54, 56, 126-134 and 140-144 should be allowable over the asserted combination.

Because Koike does not remedy Nagasaki's deficiency associated with the use of silicon nitride or other nitrogen containing insulating material, it cannot be construed as also teaching any of the structural configurations set forth in claims 126-134. Claims 126-134 recite a "gate stack over [a] substrate and beneath [a nitrogen containing] insulating layer." Nagasaki does not teach an insulating layer over any structure that can be comparable to a gate stack.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 2, 4, 25, 27, 43, 45, 54, 56, 126-134 and 140-144 under § 103 are respectfully requested.

Claims 2, 8, 10, 11, 20, 22, 23, 25, 34, 36, 37, 43, 47, 49, 50, 54, 60, 62 and 63 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the “acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki. . . further considered with Suzuki.” Office Action, at 5.

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Furthermore, it is respectfully submitted that the disclosure of Suzuki cannot compensate for the above-described deficiency of Nagasaki. The independent claims from which claims 2, 8, 10, 11, 20, 22, 23, 25, 34, 36, 37, 43, 47, 49, 50, 60, 62 and 63 depend recite a nitrogen containing insulating layer in contact with the substrate and beneath the photogate. Suzuki does not teach the use of a nitrogen containing insulating layer at the location claimed. For this reason alone, claims 2, 8, 10, 11, 20, 22, 23, 25, 34, 36, 37, 43, 47, 49, 50, 60, 62 and 63 are allowable over the asserted combination. Again, the Examiner appears to be utilizing the teachings of the present application to apply hindsight to the disclosure of Suzuki. Office Action, at 5. This analysis is improper, and the cited references do not render obvious the claimed invention.

For at least the reasons identified above, reconsideration and withdrawal of the rejection of claims 2, 8, 10, 11, 20, 22, 23, 25, 34, 36, 37, 43 47, 49, 50, 60, 62 and 63 under § 103 are respectfully requested.

Claims 1-4, 7-15, 18-23, 25-29, 31-39, 41-63, 65, 115-125, and 135-139 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over “the acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki et al, . . . further considered together with Okada et al and Anagnostopoulos et al.” Office Action, at 5.

The rejection is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention.

Furthermore, it is respectfully submitted that the disclosures of Okada and Anagnostopoulos cannot compensate for the above-described deficiency of Nagasaki. Even if Okada teaches ONO, Okada does not teach or suggest the structure claimed. The independent claims from which claims 2-4, 7-13, 15, 18-23, 25-27, 29, 31-38, 41-52, 54-63, 65, 66, 115-125, and 135-139 depend recite a nitrogen containing insulating layer in contact with a substrate and beneath a photogate. Neither Okada nor Anagnostopoulos, however, teaches Applicant’s claimed nitrogen containing insulating layer in contact with a substrate and beneath a photogate. For this reason alone, the rejected claims are allowable over the asserted combination.

Further, it is unclear what objective motivation that any of the references provides for combining the references as suggested by the Examiner. No such suggestion or motivation can be found in these references, absent application of impermissible hindsight using the present application as a roadmap.

For at least the reasons identified above, reconsideration and withdrawal of the rejection of claims 1-4, 7-15, 18-23, 25-29, 31-39, 41-63, 65, 66, 115-124, and 135-139 under § 103 are respectfully requested.

Claims 126-134 and 140-144 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the "acknowledged prior art (Figures 1, 2, pages 1-12) Nagasaki, Okada, and Anagnostopoulos, further considered together with Koike." Office Action, at 6.

The rejection is respectfully traversed. For all of the reasons identified above, the claimed invention would not have been obvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings to attain the claimed invention. M.P.E.P. § 2143.

It is respectfully submitted that the disclosure of Koike cannot compensate for the above-described deficiencies of the other applied references. Applicant's independent claims from which claims 126-134 and 140-144 depend recite a nitrogen containing insulating layer in contact with the substrate and beneath the photogate. Koike does not suggest Applicant's claimed nitrogen containing insulating layer configuration.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 126-134 and 140-144 under § 103 are respectfully requested.

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In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

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